NEW ABSTRACT:

Please replace the original abstract with the following new abstract:

Abstract of the Disclosure

A fuel injection systems for direct-injection diesel engines, has a piezoelectric actuator contained in an injector body and acted on by a first spring mechanism so that it remains in contact with the injector body at one end and with a sleeve-like booster piston on the other. A nozzle body connected to the injector body has at least one nozzle outlet opening, and in which a stepped first nozzle needle an axially movable, and a second spring mechanism is contained inside the booster piston and the injection pressure hold the first nozzle needle closed. An outer control chamber communicates via at least one leakage gap with a fuel supply under injection pressure; fuel in the control chamber acts on the first nozzle needle in the opening direction. A large diameter rear region of the first nozzle needle is fitted into the internal chamber of the booster piston. A stepped concentric axial recess passing through the first nozzle needle and a second nozzle needle correspondingly stepped is fitted into the first nozzle needle, and a second inner chamber is hydraulically connected to the first outer control chamber. The control chamber volumes and the surfaces of the nozzle needles, matched so that the two nozzle needles open in succession in response to a change to the electrical voltage applied to the piezoelectric actuator.